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A FEASIBILITY STUDY FOR AN EMERGENCY MEDICAL SERVICES SYSTEM TO
SERVE THE PERMIAN BASIN IN THE STATE OF TEXAS

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FINAL REPORT

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1.0 INTRODUCTION

The basic objective of Contract NAS9-14397 was to assist with preparation of an Emergency Medical Services (EMS) System grant application for the 17-county Permian Basin Region of West Texas. This objective was met on March 28, 1975, with delivery of 15 copies of the grant application to the NASA Technical Monitor. In addition, 30 copies of the grant application were mailed to the Permian Basin Regional Planning Commission on March 28. In turn, the Permian Basin Regional Planning Commission delivered the grant application to the U.S. Department of Health, Education, and Welfare on March 31, 1975. All other items required under this contract, including an Executive Summary of the grant application, have been delivered to the Technical Monitor under separate cover.

This final report summarizes the approach used for preparing the grant application, discusses the application of NASA-developed technology, and provides selected conclusions and recommendations.

2.0 PREPARATION OF GRANT APPLICATION

The following steps were used to develop the Emergency Medical Services (EMS) System grant application:

1. Definition of strengths and weaknesses of existing EMS resources in the Region through use of surveys and studies.
2. Definition and analysis of potential approaches for improving EMS capabilities.
3. Development of plans for implementation and operation of the comprehensive regional EMS System.
4. Preparation of grant application.

A four-year program has been planned for developing the comprehensive EMS System under Public Law 93-154. The grant application was developed for the first year of the four-year program. A separate grant application will be required for each succeeding year of the program. The overall plans and schedules in the grant application were structured to reflect the total four-year program.

The 15 components that comprise an EMS System will be developed in a time-phased fashion during the four-year program (Table I).

TABLE I. EMS System Components

1. Manpower
2. Training
3. Communications
4. Transportation
5. Facilities
6. Access to Critical Care Units
7. Utilization of Public Safety Agencies
8. Consumer Participation
9. Accessibility to Care Without Ability to Pay
10. Provision for Transfer of Patients or Continuum of Care
11. Standardized Medical Record Keeping
12. Consumer Information and Education
13. Independent Evaluation
14. Disaster Planning
15. Mutual Aid Agreements

A significant problem in preparing the grant application was definition of the best approaches for time-phased development of each of the 15 EMS System components. The first two years will be used to develop a good 24-hour, 7 days-a-week emergency care capability for all individuals in the Region. The final two years of the four-year program will include development of advanced capabilities such as air ambulance service and widespread use of biomedical telemetry.

3.0 EMS SYSTEM GOALS

Goals established for the regional EMS System are summarized in Table II. As the EMS System is developed, definition of the goals will be improved and new goals will be added. Ideally, each of the goals should have a direct quantitative relationship with the fundamental EMS System purpose of saving lives and minimizing temporary and permanent disability.

TABLE II. EMS SYSTEM GOALS

GOAL	EMS SYSTEM COMPONENT	REMARKS
<p>1. To establish a comprehensive emergency medical services capability for at least 80 percent of the Permian Basin Region by July 1976. Based on an overall systems approach, develop each of the 15 EMS System components in a time-phased manner that will maximize benefits provided to the Region by the EMS System. To initiate program evaluation consistent with verification of EMS System performance and benefits at the earliest possible date.</p>	A11	Fundamental long-range goal. Goals 1 through 4 comprise the most basic EMS System goals.
<p>2. To establish a basic life support capability throughout the entire Permian Basin Region by July 1977. To establish a capability that meets or exceeds standards for con-temporary emergency medical services in similar settings in the United States. To make necessary improvements in pre-hospital and in-hospital care, and to provide continuum of care during patient transfer to special care centers. To continuously concentrate on improving EMS System evaluation including verification of performance and benefits.</p>	A11	See Goal 1.
<p>3. To establish and develop an advanced emergency medical services capability that meets or exceeds national standards by July 1979. The advanced System will employ a rigorous doctor-nurse-EMT team approach for providing emergency care with biomedical telemetry. To initiate research programs for advanced life support in affiliation with Texas Tech Medical School.</p>	A11	See Goal 1.

TABLE II. (Continued)

GOAL	EMS SYSTEM COMPONENT	REMARKS
4. To develop, to operate, and to obtain support for the EMS System through a sound socio-financial program that will enable the System to become financially self-sufficient by July 1980. At this date, local revenues will be sufficient to provide necessary continuing improvements to maintain the System as a national model for community and rural medicine.	All	See Goal 1.
5. Development of the EMS System will be focused on the following areas of critical-care medicine: <ol style="list-style-type: none"> Critical trauma cases including multiple internal injury, spinal injury, and burn cases Acute cardiac events Perinatal high-risk mother and infant care with neonatal high-risk cases included Child abuse and neglect cases Poison cases Acute psychiatric care Acute drug overdose and alcohol detoxification programs Other true medical, surgical, and mental health emergencies 	All	On a national basis, about 80 percent of emergency cases are not true emergencies and should be appropriately triaged out of the EMS System. Of the remaining 20 percent, 15 percent are true emergencies and 5 percent are high-risk critical cases. The 5 percent critical cases are generally not surviving in rural areas. Development of the EMS System will place emphasis on providing critical care medicine for this high-risk group.
6. Develop doctor-nurse-EMT teams for providing critical-care medicine to all areas in the Region on a 24-hour, 7-day week basis. Support these teams with an extensive array of personnel resources for handling the numerous functions associated with EMS System planning, implementation, operations, and evaluation. The EMS System will make maximum feasible use of the capabilities of all existing organizations in the Region.	Manpower	Doctor-nurse-EMT teams are needed for providing effective community and rural critical-care medicine. Close-knit doctor-nurse-EMT teams will be developed for the entire Region.

TABLE II. (Continued)

GOAL	EMS SYSTEM COMPONENT	REMARKS
7. Develop first-response teams for the large rural areas and numerous small communities. These teams will use private motor vehicles to go to the scene and provide emergency care without benefit of an ambulance vehicle. The teams will be part of the basic doctor-nurse-EMT teams and will be linked to the EMS communications network. The first-response teams will provide care until an ambulance arrives, or, when appropriate, will transport the patient without use of an ambulance.	a. Manpower	It is not financially feasible to provide ambulance vehicles for the large rural areas and numerous small communities.
8. The overall training program will be structured in a fashion that will catalyze formation of doctor-nurse-EMT teams for all locations in the Region. Comprehensive training programs with continuing education.	b. Training	Training programs for the doctor-nurse-EMT teams will be provided by local colleges and universities. Training for doctors will be obtained through affiliation with the Texas Tech Medical School.
9. The goal of EMS communications is to develop the necessary system which is functional on a daily operational basis and in disaster situations, and which can coordinate emergency medical resources and public safety services required for the most appropriate care and transportation of the patient.	c. Communications	The EMS communications network will be developed over a four-year period. Procurement specifications will be prepared during the first year of the four-year program. Communications is the most expensive component in the EMS System.
10. The existing EMS transportation capability will be steadily improved over the four-year EMS System development period to provide a complete network of ambulances and special vehicles to appropriately respond to all locations in the Region on a 24-hour, 7-days a week basis. The first two years will be dedicated to improving the basic overland transportation capability and for improving the capability for long-range air transport to special care centers outside the Region. The final two years will be used to develop an advanced EMS transportation capability consistent with the medical needs and geography of the Region.	d. Transportation	Development of this EMS System component will require other sources of funding to supplement funds available under Public Law 93-154. In many states, transportation funding is provided by the U.S. Department of Transportation. To date, this has not been the case in Texas. This problem will be appropriately resolved through the Permian Basin Regional Planning Commission.

TABLE II. (Continued)

GOAL	EMS SYSTEM COMPONENT	REMARKS
11. Hospitals within the Region will be functionally categorized during the first year of the four-year EMS System development program. Categorization will be updated as appropriate to reflect changes in hospital resources and capabilities. Categorization will be developed in a fashion that will unify available resources.	e. Facilities	Categorization will be based on Texas State Department of Health guidelines currently being developed. Near real-time categorization will be used to reflect critical changes caused by patient loading and the availability of key medical professionals.
12. The following special regional capabilities will be established: A special capability for burn care will be established at the Odessa Medical Center; a special regional capability for high risk perinatal cases will be established at the Women's and Children's Hospital at Odessa.	f. Access to Critical Care Units	The cost of these special care resources will be relatively high. The exact cost will not be known until detail plans are developed during the first year of the four-year program. The perinatology program will include a broad program of preventive medicine.
13. Appropriate linkages will be developed with critical care units outside the Region. Linkages will be developed with special care facilities at San Antonio, Galveston, Houston, Dallas, and the Texas Tech Medical School at Lubbock. Special linkages will be developed for burn patients, high-risk perinatal mother and infant (including high-risk neonatal), and for spinal injuries. Linkages will be developed during the first year of the four-year program.	g. Access to Critical Care Units	Major burn care centers are located at San Antonio, Galveston, and Dallas. Houston has a major spinal care facility. San Antonio, Houston, and the Texas Tech Medical School have special care facilities for high-risk perinatal care (including care of high-risk neonatal cases).
14. All public safety organizations in the Region will be linked to the EMS System through affiliation with the doctor-nurse-EMT teams.	h. Utilization of Public Safety Organizations	Additional EMS organizations to be established in the Region are to be operated by public safety organizations. Fourteen of the existing twenty-four ambulance organizations are operated by public safety organizations.
15. Strong Consumer participation is to be a fundamental part of the EMS System.	h. Consumer Participation	A financially self-sufficient EMS System cannot be developed in the Region without unusually strong consumer participation.

TABLE II. (Continued)

GOAL	EMS SYSTEM COMPONENT	REMARKS
16. It will be a fundamental objective of EMS System implementation and operations to develop a satisfactory regional solution to the medical "charity case" problem during the first year of the four-year program. It will be a further objective to begin implementing the solution during the second year of the program. The overall objective will be to develop a fully operational capability by July 1, 1979.	i. Accessibility to Care Without Ability to Pay	This goal is recognized to be a difficult problem.
17. Highly functional agreements, policies, and procedures for patient transfers within the Region and to special care facilities outside the Region will be developed. Appropriate agreements will also be developed with neighboring areas for the sharing of patient-transfer resources for selected critical care cases and for disaster operations.	j. Provision for Transfer of Patients or Continuum of Care	
18. A standardized Medical Record Keeping System will be developed through cooperation with the Texas State Department of Health and the U.S. Department of Health, Education, and Welfare.	k. Standardized Medical Record Keeping	Numerous hospitals in the Region have offered assistance for developing an appropriate Standardized Medical Record Keeping System. The Record Keeping System must be developed and made operational at an early date.
19. Consumers will be continuously made aware of the best approaches for rapidly and effectively entering the EMS System. In addition, consumers will continuously be made aware of the capabilities, goals, objectives, and benefits of the EHS System.	l. Consumer Information and Education	All individuals in the Region must be made adequately aware of how to use the EMS System. Consumer support is needed to make the System financially self-sufficient.

TABLE II. (Continued)

GOAL	EMS SYSTEM COMPONENT		REMARKS
20. Independent evaluation will be provided as a top-level management tool for providing information on which to base key management decisions for improvement of the EMS System.	m.	Independent Evaluation	Independent evaluation will probably be performed by the newly founded Texas Tech School of Medicine.
21. The comprehensive EMS System will be rigorously developed for providing the required disaster response capability. A specific operational requirement will be to conduct day-to-day EMS System operations through use of operational approaches that will continuously exercise functions and systems required for disaster relief operations.	n.	Disaster Planning	Comprehensive emergency operations plans currently exist. These will be updated to properly reflect the comprehensive regional EMS System.
22. Mutual Aid Agreements will be developed with neighboring areas in Texas and New Mexico to provide critical-care medicine on a reciprocal basis.	o.	Mutual Aid Agreements	Mutual Aid will not be required except for extreme disaster situations.

4.0 SYSTEM REQUIREMENTS

The EMS System grant application was prepared in accordance with Public Law 93-154. Guidelines were provided by HEW for interpretation of the law. In addition, numerous requirements were given at several conferences held by the HEW. The basic HEW guidelines are contained in Appendix B of the grant application.

5.0 SPECIAL SYSTEM CHARACTERISTICS

Special characteristics of the planned EMS System are presented in detail in the grant application. Following is a summary of selected special characteristics envisioned for the EMS System:

- a. Use of closely knit doctor-nurse-EMT teams
- b. Four-year EMS System development program
- c. Emphasis on specific areas of critical-care medicine (Table II)
- d. Logical phased improvement of existing resources
- e. Development of special regional burn center
- f. Development of special regional perinatology capability
- g. Emphasis on preventive medicine as well as acute care aspects
- h. Emphasis on physician program direction
- i. Affiliation with Texas Tech Medical School for Systems evaluation and for long-range development of advanced EMS capabilities

6.0 APPLICATION OF NASA-DEVELOPED TECHNOLOGY

The areas for potential application of NASA-developed technology are discussed below.

EMS Communications Network - NASA has supported the development of biomedical telemetry units for use in EMS Systems. This technology is well suited to the cities of Odessa, Midland, and Big Springs in the Permian Basin Region. The relatively high cost of currently available units makes them unsuitable for rural areas and small communities. Suitable low-cost biotelemetry units are needed for the Permian Basin Region.

The problem of developing an adequate EMS communications network for a large Region is relatively difficult. There is need for a fairly large amount of communications systems engineering. NASA could provide considerable assistance in the area of communications system design and specification development.

Training - NASA has a high capability for developing system simulators and training devices. This expertise may be applicable to the Permian Basin EMS System. A major problem will be to provide realistic continuing education in the large rural areas and numerous small communities. The training levels in the rural areas need to be higher than for a metropolitan area because patients cannot be immediately transported to a sophisticated hospital. In many cases, critical care must be provided for an hour or more before the patient arrives at a hospital. NASA-developed technology may be useful in developing sophisticated training systems for this environment. The training systems would be employed in a fashion that would help to catalyze development of high-performance doctor-nurse-EMT teams.

Program Management - The EMS System development program is relatively complex and the System is to be developed at a relatively rapid pace. The program could benefit significantly from systems management approaches developed by NASA.

Standardized Medical Record Keeping - NASA experience with the development of medical record keeping systems may be applicable to the Permian Basin EMS System.

7.0 CONCLUSIONS

- a. Significant improvements in emergency medical care can be provided through development of comprehensive regional EMS Systems such as that proposed for the Permian Basin Region.
- b. A regional EMS System is relatively complex. Advanced management techniques are needed for EMS System implementation and operations.
- c. New approaches are needed for providing significant improvements in critical care medicine. The use of closely knit doctor-nurse-EMT teams will provide a significant improvement in emergency care. Special training systems are needed for helping to develop and maintain high-performance doctor-nurse-EMT teams.
- d. Communications is the most complicated engineering problem in the EMS System. In this area, there may be numerous opportunities for applying NASA-developed technology.